# CHAPTER 4

## Laboratory Organization, Methods, and Processes

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### Laboratory Organization

This chapter describes the organization of skeletal recordation in the laboratory. This work requires specialized personnel, task teams, and processes that convert fragile fragments of soil-encased bone into skeletal elements that reveal accurate anatomical structure and observable effects of physiological processes that can be assessed for genetic, demographic, and pathologic information. That information is then coded and entered into a computer database where all information on each individual can be tracked and statistical data on sample groups of skeletons can be manipulated. Skeletal recordation was completed in 1999 resulting in an estimated 250,000 observations on the 419 human remains. Photographic and radiographic documentation and sampling of bone and dental tissue were also undertaken for future research. A collection containing more than 55,000 photographs (mainly slides and digitized images) and over 2,000 x-ray radiographs, and a small sample of cranial CAT scans has been assembled.

Skeletal recordation (processing and data collection) was conducted in The W. Montague Cobb Biological Anthropology Laboratory of Howard University. The Cobb Laboratory consists of approximately 3,000 square feet of space. Three laboratory rooms, a storage room and hallway, and two offices comprise the laboratory, which is equipped with electronic security and environmental controls throughout. During the study, room

## Facilities and Environment

**Figure 4.1: Work space in the main "blue" laboratory**

temperature was maintained as 70-72% F and 50% relative humidity. Three free-standing back-up dehumidiflers were used during summer rains, when humidity briefly exceeded the desired level. Humidity was monitored by hygrometers in each laboratory room, and a hand-held hygrometer was used to monitor the interior environment of skeletal storage boxes. Only once was there an observed distortion of bone due to humidity, involving slight expansion of a postmortem humeral fracture that had been out on an examination table during a roof leak. The airtight interior steel cabinetry in which remains were stored further limited the effects of environmental fluctuations in bone.

Exterminators eliminated pests annually. Moth crystals are regularly used inside cabinets of the laboratory's permanent anatomical collection (The Cobb Human Skeletal Collection) but were not required of the African Burial Ground (ABG) remains. No evidence of insect or mammal infestation was observed in this collection during skeletal recordation.

Fungi were observed in 25 skeletons, and two additional skeletons were isolated with the 25 infested cases because of their close proximity to one of them. Procedures for handling these cases will be discussed in Chapter 4.0. All skeletons were sampled for fungus identification and stored in airtight interior steel cabinets labeled with OSHA-required biohazard signs.

The laboratory is equipped with benches, tables, stools, clean bench, fume hood, proper lighting, sinks, refrigerators, photography equipment, small x-ray machine, computers, mechanical and digital calipers, microscope, and other necessary research tools.

**Personnel**

The following Cobb Laboratory personnel were involved in skeletal recordation and related administration of the African Burial Ground Project (ABGP).

**Project and Scientific Director:**

The Scientific Director had responsibility for all project administration and scientific design, research, and reporting as well as public and client relations. The Scientific Direcctor organized, controlled quality, and directed all research activities and wrote all research designs, cost proposals, and reports with the assistance of senior personnel. This position coordinated all components of research within and apart from The Cobb Laboratory. A Ph.D., experience, and scholarly productivity in bioarchaeological research were requirements for this position.

**Laboratory Director/Osteologist:**

The Laboratory Director was responsible for laboratory management including relevant organization, technician training and quality control, supervision, and maintaining adequate laboratory supplies. The Director was also responsible for dental data collection and contributed to research analysis, reporting, and public and client relations. The Director managed the flow of information and materials exchange with other laboratories; scheduled and conducted public tours, and reported to the Scientific Director. An M.A. and experience in bioarchaeology were requirements for this position.

**Office Manager/Administrative Assistant:**

The Office Manager had oversight of office management including the laboratory's payroll, bookkeeping, purchasing, travel arrangements, communications, records keeping, and assisted the Scientific Director in all administrative tasks of the project while supervising clerical staff. A B.A. in management and clerical experience were requirements for this position.

**Osteologist:**

The Osteologist conducted assessments of bone pathology with the Scientific Director's supervision and assisted the Laboratory Director and Scientific Director in technician training and quality control. The Osteologist supervised assisting technicians, advised photography as needed, and contributed to analysis and reporting. An M.A. and experience in paleopathology were requirements for this position.

**Osteological Technicians (OT), four simultaneous positions:**

Osteological Technicians conducted age and sex assessments and anthropometric measurements, supervised processing staff and quality control at their work stations, supervised or conducted photography and radiology as needed, assisted curation, and conducted public tours. The most experienced Osteological Technicians conducted bone pathology and dental assessments under supervision of the Scientific Director and Laboratory Director and contributed to analysis and reporting. Osteological Technician Assistants reported to the Lab Director (except those persons conducting bone pathology assessments), who also reported to the Scientific Director. A B.A. in anthropology and experience in skeletal biology were requirements for these positions.

**Osteological Technician Assistants (OTA), up to 12 simultaneous positions:**

Osteological Technician Assistants assisted in all technical tasks of recordation, especially processing which includes pedestal reduction, cleaning and reconstruction of skeletal elements, photography and its organization, inventory radiology, and public tours. The most advanced OTAs were also involved in supervised anthropometric measurement, dental casting, sectioning and sampling of bone, and curation. OTAs mainly reported to the OTs, and were assigned to the Laboratory Director and 0steologist as needed. OTAs were graduate and undergraduate students of anthropology, anatomy, human development, history and those fields, who had completed a course in human osteology and had specialized training in recordation techniques in the Laboratory.

**Medical Photographer:**

The Medical Photographer undertook photographic documentation of skeletal observations and inventory, manages the photography laboratory, and assisted in purchasing photographic equipment and supplies, and kept the log of photographs. This position reported to the Laboratory Director and was advised by Osteologists and OTs.

The Medical Photographers were required to have experience in skeletal recordation photography or a related subject of medical photography.

### Data Systems Manager:

The Data Systems Manager was responsible for maintaining the relational and statistical data bases, computer hardware and software, and produced statistical analyses for the Scientific Director. This position reported directly to the Scientific Director and required an individual with at least a B.A. and experience in database management.

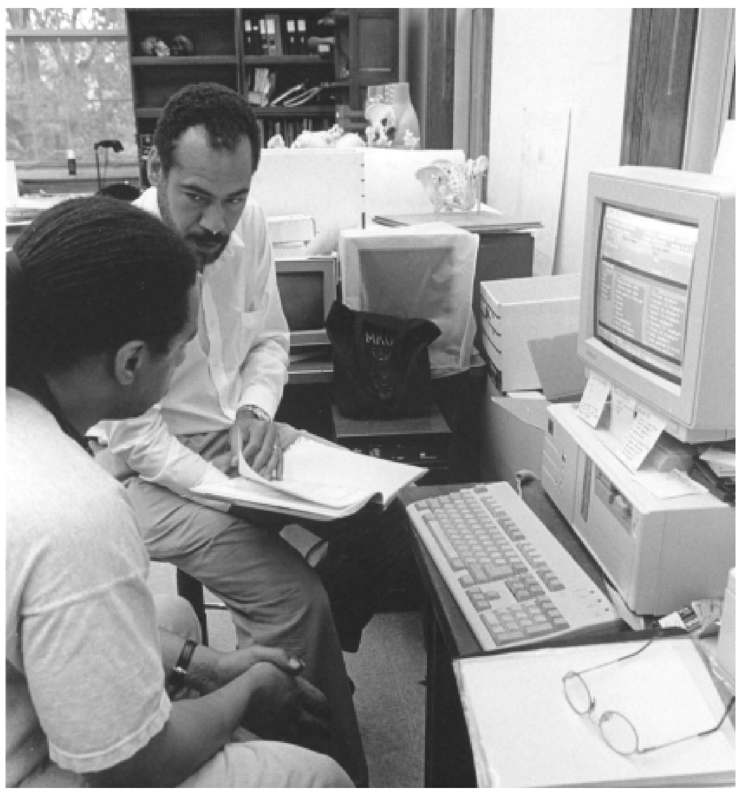

**Figure 4.2: Data Systems Manager Douglas Fuller, and Project Director Michael Blakey discuss organization of the database**

**Botanist, two positions:**

The Project Botanists sampled and identified fungi (molds), determine their genera, advised the Scientific Director regarding any potential biohazards, and recommended biocides and safety procedures. These Botanists reported to a Senior Botanist with a Ph.D. Enrollment in a doctoral program in botany was a requirement for this position.

**Conservators, two positions, as needed:**

Conservators were contracted as consultants to work as needed to stabilize artifacts found during skeletal processing. They reported to the Scientific Director.

**Consultants and Specialists, several positions:**

Consultant positions were filled by specialists in bone and dental chemistry, DNA, and histology, and the Associate Director for Biological Anthropology and other senior researchers. These consultants, in general, held the Ph.D. and were recognized nationally or internationally as leading scholars in their areas of specialization.

**Secretary:**

The Secretary reported to the Office Manager, was responsible for communications, and assisted with all clerical work.

The above positions comprise the technical, management, and administrative staff of the Cobb Laboratory. All laboratory staff collectively contributed to the interdependent processes required for all data collection and analysis. Weekly meetings and periodic training sessions facilitated staff development and the integration of laboratory tasks. Respect for specialized skills and responsibility for productivity was part of a laboratory philosophy that also emphasized training. Each member of the team was expected to teach others how to perform the member's work (to make that individual "redundant") as a means of continual improvement of the laboratories resources and opportunities for individuals.

**Figure 4.3: Cobb Laboratory staff**

## Burial Processing and Methodology

### Cleaning and Reconstruction

During burial processing, osteological technicians (OTs) and osteological technician assistants (OTAs) wore latex (or non-allergenic) examination gloves, dust masks and laboratory coats as a barrier to contagion and the contamination of bones with the researcher's DNA. All sachets (acid-free tissue packets with bones) were wrapped for shipment and storage.

**Figure 4.4: Safety while unwrapping burials**

In addition to wearing the protective clothing mentioned above, respirators replaced dust masks when sachets were opened for the first time, because of the unknown nature of fungi that had infested some of these remains in New York. If no molds appeared to be present, the technicians proceeded with cleaning, reconstruction, and data collection. If molds did appear to have infested the remains, the entire burial was immediately isolated in airtight cabinets until Project Botanists could sample these molds for identification. After the application of ethanol as a biocide, some fungal infested remains would later be processed under conditions specified by the University Biohazards Committee guidelines. Two remains infested with nonhazardous levels of the harmful and enigmatic fungus, Blastomyces (and three individuals located near to them which shared the same cabinet) were to remain quarantined.

**Figure 4.5: OTA Joseph Jones involved in cleaning and reconstruction.**

Each skeleton was cleaned of the surrounding soil matrix in order to observe bone surfaces for information. In many instances the remains were encased in soil blocks or "pedestals" which had to be reduced by excavating away as much of the soil as was practical in order to remove or reveal bones. The Scientific Director Lab Director or Osteologist advised the OTs and OTAs on the extent of possible reconstruction, efficient techniques for cleaning and reconstruction under different circumstances, and made decisions about immediate photography or data collection to prevent data loss when bones seemed in jeopardy of collapse. It was often not feasible to spend many hours or days completely reducing soil pedestals or reconstructing tiny fragments of bone when they could ultimately reveal little information due to very poor preservation. Frequently the block of soil matrix was all that prevented a bone from disintegrating, making it advisable to expose as much informative bone as possible while keeping it partly encased and maximally intact. Photographs were regularly taken before and after the pedestal reduction process for full documentation, since some friable bones and important observations will inevitably disintegrate when removed from soil that reinforced their integrity. The vast majority of skeletal elements, however, were removed from their matrices and observed complete.

Cleaning was accomplished with small dental tools, brushes, and cotton applicators used to apply a 75 percent ethanol/ 25 percent water solution in order to soften soil that had become dehydrated and hardened in New York. Measures were taken to minimize the application of ethanol to the bone itself, however, in order to limit destruction of DNA-bearing proteins. Bones earmarked to be sectioned were flagged with colored tape to be sampled for later genetic, histological, radiographic, and chemical analyses. When archeological artifacts such as floral and faunal remains, beads, shroud pins or coffin nails were recovered, they were stabilized by conservators, recorded on individual artifact location maps for each skeleton and sent to the archaeological laboratory for curation and analysis.

Whenever practical, fragmented skeletal elements were reconstructed using polyvinyl acetate (PVA) as an adhesive so that anthropological measurements, observations, and assessments would be maximized. The application of PVA was also minimal. Bone surfaces were not coated in order to reduce contamination of chemical studies and to leave the bone surface un-obscured. After the skeletal elements of an individual were cleaned and mended, initial data collection (inventory, age and sex estimation) was performed by the Osteological Technician responsible for that burial with the advisement of the Laboratory Director and/or the Osteologist.

## Data Collection and Skeletal Assessment

An inventory of all complete and fragmented skeletal elements was conducted for each burial to ascertain the relative state of preservation for each individual and the number of skeletal elements and their aspects that could be used as "populations" for group comparative purposes. For example, a research question concerning the knee joint might refer to the number of arthritic distal anterior femora (the upper part of the knee joint) as a percentage of all observable distal anterior femora, not as a percentage of skeletons from the Burial Ground. Therefore, keeping careful records of the preservation status of every significant bone by aspect (proximal third, middle third, <25% present, etc.) provides an important statistical control. The inventory was conducted according to Standards for Data Collection from Human Remains (Buikstra and Ubelaker, 1994) hereafter referred to as the Standards.

A skeletal inventory was taken of every observable bone and tooth with the following preservation scores:

blank = missing data
1= >75% present = complete
2= 25% - 75% present partial
3= <25% present = poor

The preservation of vertebra bodies and neural arches were recorded separately. Long bones were given separate scores for proximal end, proximal third, middle third, distal third, and distal end. An accounting of the preservation status of this archaeological sample is provided as Appendix C.

An anthropometric record was compiled for each measurable cranial dimension and postcranial element whose measurement bore potentially useful information.

Measurements were not taken if damage, incomplete preservation, warpage, or limited reconstruction made accurate measurement improbable. Occasionally, measurements were approximated for bone elements with minimal alteration of size (as in some cases in which exfoliated cortical bone produces a 1-2 mm difference in length), and in which we estimate where the landmark had been and the degree of error involved. Any approximated measurements were specifically noted.

**Figure 4.6: Allison Davis and Keisha Hurst take anthropometric measurements**

Measurements were taken bilaterally and in the metric system, using the following instruments as appropriate: a) digital sliding caliper; b) spreading caliper, c) osteometric board, d) measuring tape, and e) mandibulometer.

Separate forms were used to record measurements for immature (<20 years) and adult remains. All measurements for "infants" (fetal-3 years) were taken according to standards recommended for immature materials. Postcranial measurements for children

(3-12 years) and for adolescents (12-20 years) were recorded according to the same standards; however, when sufficiently complete, cranial and mandibular measurements were taken according to the more extensive adult anthropometric standards. Adolescent bone elements with fused epiphyses were considered adult and measured as such.

Quality control was maintained by recording two sets of measurements for each skeleton, taken by different technicians or on different dates. The two sets of measurements were then compared in order to assess the degree of difference between them. When the degree of difference was greater than five percent of the average value of two measurements, then a third measurement was taken and compared to the previous two. This process continued until two measurements remained with a degree of difference of less than five percent. These two measurements were then averaged for analytical purposes. The five percent rule was applied as an alert to serious error. In fact, acceptable measurements were always much closer together than 5 percent of the size of the bone. We are confident of the accuracy of the final mean measurement used in our studies. The last two sets of measurements taken are available for examination as part of the permanent record of the project.

**Sex Determination**

Determination of sex was based on observed skeletal variations in shape and size known to differ between males and females. Each of ten cranial, seven pelvic, and seven other postcranial characteristics were assigned a score on a scale of one to five, with one demonstrating typical female configuration, five marking male morphology, and three indeterminate. In most cases, a sex determination was achieved by finding the average score for all attributes. Commonly, however, skeletons with average scores denoting one sex also exhibited some characteristics indicative of the other sex. In such cases, greater weight was given to the most reliable sex determinants (elaborated below). When poor preservation eliminated all reliable sex indicators, sex was estimated as undetermined. Rationales for sex determination were recorded in the section reserved for comments in addition to the 24 item score sheet. Age was always a consideration when estimating sex, as many older skeletons may undergo degenerative changes, such as bone resorption or remodeling, which, if not accounted for, can complicate a sex assessment and sex assessment in children is questionable categorically. We consider our sex assessments to be reliable for individuals who were 15-19 years of age and older. While there are currently no widely accepted standards for determining sex in younger juveniles, a specialized study was conducted using an experimental approach that will be included in a subsequent chapter of this report.

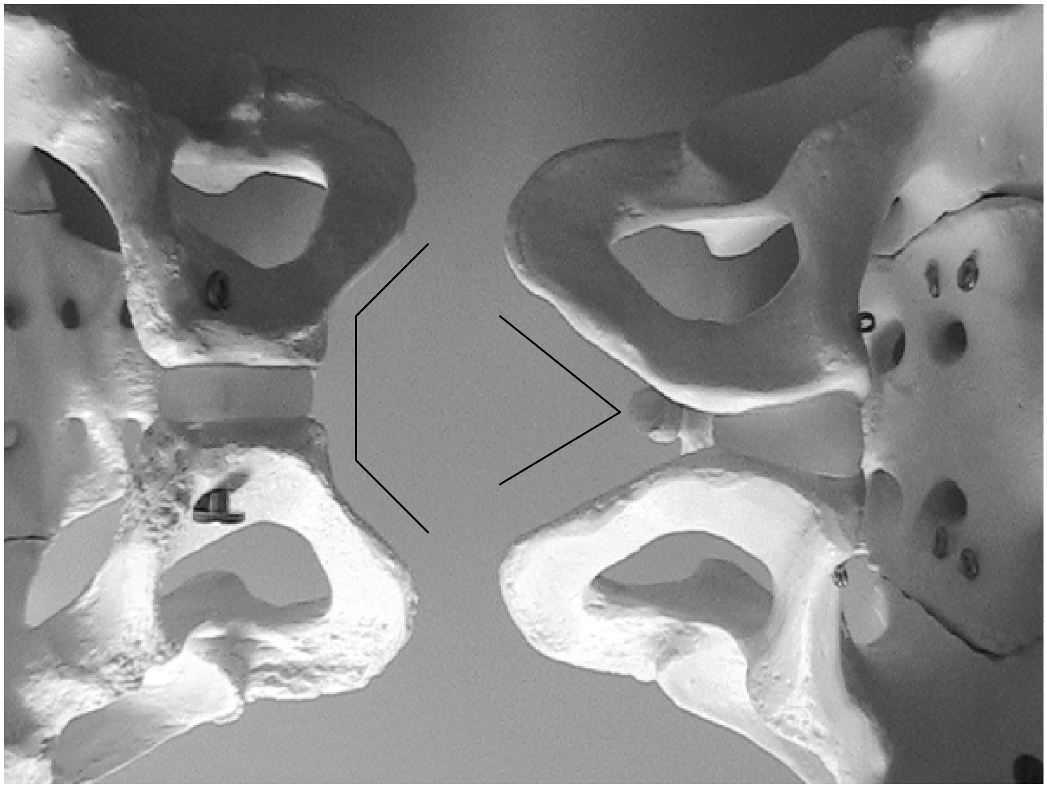

**Figure 4.7: Comparative male and female pelvic shapes. Note the wide subpubic angle in the female (left) in relation to the male (right)**

When sufficiently complete, the pelvis is the most reliable indicator of sex. The subpubic angle, the ventral arc (Phenice 1969), and the presence or absence of the pre-auricular sulcus is particularly useful. Each trait was evaluated independently according to standards delineated by Phenice (1969) and Sutherland and Suchey (1991) and others. Older adolescent individuals whose pelvic bones showed qualitatively distinct female characteristics were generally assessed as female. An adolescent pelvis exhibiting-male patterns, however, was considered ambiguous, as this could have also represented a female skeleton that had not yet reached full maturity (Buikstra and Ubelaker 1994:16). Considerable additional data would be needed to establish the sex of such a person.

Though not so reliable as the os coxae, estimation of age based on cranial morphology was also very useful for sex determination, especially in cases involving "typically" robust or gracile features. Each trait was scored according to standards described by Bass (1971, 1987), Krogman (1955, 1962), and Buikstra and Ubelaker (1994). For adolescents, in the absence of convincing pelvic indicators, a robust cranium was interpreted as an indication of overall maleness, while a gracile skull often resulted in an ambiguous overall diagnosis. Older age was also a consideration when determining how much influence to assign to cranial features in an overall sex assessment, as many adult skulls of either sex may exhibit a more masculine morphology with increasing age (Meindl et al., 1985). Additionally, with tooth loss, the mandible may undergo remodeling, which can also complicate sex determination.

**Figure 4.8: Geriatric left mandible for which long-standing toothlessness has obliterated most evidence of dental 'sockets' (Burial 209)**

Post-cranial dimensions proved highly variable with this sample. Measurements were taken and applied to the guidelines for sex determination in Dittrick (1979) and

Thieme (1957). Many of the measurements conflicted with more accurate indicators such as pelvic morphology; therefore, they were often of less value in sex estimation. Except in cases of denoting "typical" maleness/ femaleness, postcranial measurements (length of long bones, for example) were usually assigned less weight in sex determination than reproductive anatomy (pelvic characteristics). Given the robusticity of many of the ABG females, sexual characteristics that were not heavily influenced by biomechanical factors were favored over those that were most influenced by muscularity.

**Age Determination**

Estimation of age-at death involves the observation of numerous indicators of growth, development, and age-related degenerative changes. The desired "composite age" for each individual consists of an estimated age-range and mean age (mean of age range) obtained by an evaluating and weighing the age estimates derived from several different aging criteria (such as epiphyseal closure and dental attrition). The estimates of each criterion are also usually based upon age scores or estimates from a variety of bones or teeth. Although efforts were made to provide a mean age and age range for each skeleton assessed, advanced age and/or poor preservation sometimes rendered this impossible. In such cases, only a minimal age was given (e.g. x> 55).

When it was impossible even to calculate a minimal age, an attempt was made to assign the skeleton to one of the age classes listed in *Standards for Data Collection from Human Remains* that include perinatal, infant, child, juvenile, adolescent, or adult. We were successful in estimating reliable upper and lower age ranges on three quarters of the skeletal population without resorting to these general categories. The demographic analyses of the project rely solely upon this large group of accurately aged individuals.

Rationales for ages were provided in the section reserved for comments on the Age Determination form, and photographs were taken as supporting evidence for these estimates.

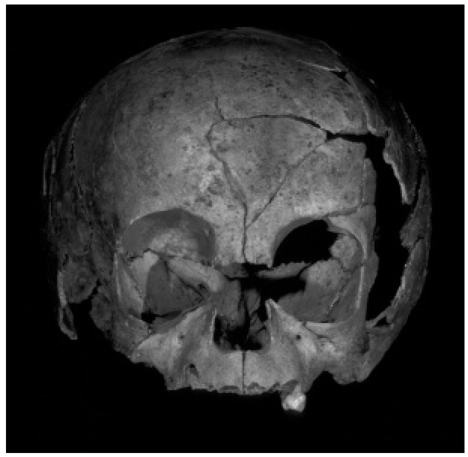

**Figure 4.9: Cranium of infant 1-2 years of age (Burial 252)**

**Figure 4.10: Child 5-7 years of age (Burial 39)**

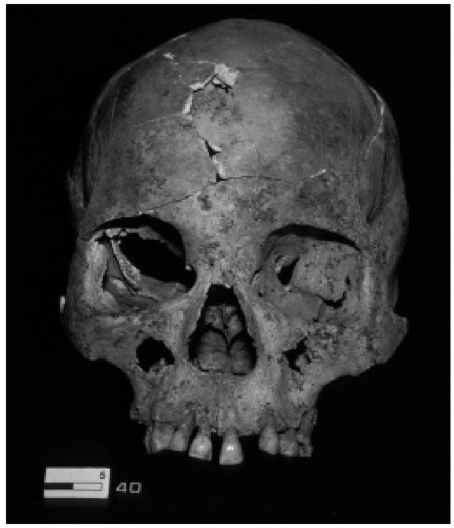


**Figure 4.11: Elderly woman 50 - 60 years of age (Burial 40)**

For immature remains, composite age was determined by evaluating dental development, epiphyseal and primary ossification center fusion/union, and/or long bone diaphyseal length. When possible, tympanic plate development was also evaluated for infants. Because of its high variability, long bone diaphyseal length (and iliac width) was used as a primary age indicator only when no other elements were sufficiently preserved. Dental development, being little influenced by environmental factors, is the most accurate indicator of subadult age. Dental development was evaluated according to sequences of tooth formation and eruption compiled by Ubelaker (1989; 1986), Gustafson and Koch (1974), and Moorrees, Fanning, and Hunt (1963a, 1963b). Up to 75 different developmental indicators were evaluated in estimates of the ages of immature individuals. Of these indicators, 32 are observations of epiphyseal union and primary centers of ossification, each of which was scored in 3 stages that include non-union, partial union, and complete union of the epiphyses and metaphyses of bones that correspond to different developmental ages.

Figure 4.12:
**Mandible of 9-10 year old child with permanent teeth in various stages of eruption compared with a dental aging chart (Ubelaker 1989) showing ages associated with different eruption stages**

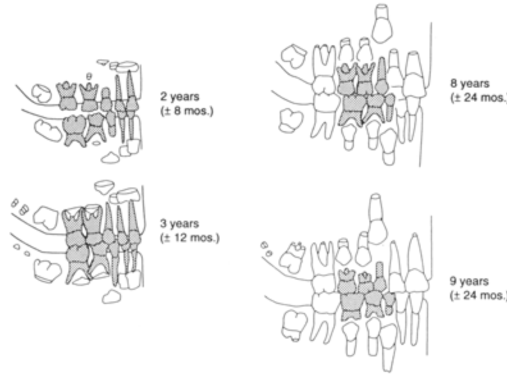


**Figure 4.13:**
**Deciduous teeth are shown in grey; permanent teeth are shown in white. The arrow points to a 9-year-old's development**

Degree of fusion for epiphyses and primary centers of ossification was also a valuable age indicator, yet, there were a number of cases in which ages reached by assessing union were inconsistent with those determined by observing dental development. When this occurred, greater weight was given to dental development because of the greater environmental influences on bone growth and development. Fusion of primary ossification centers was evaluated for the vertebrae, os coxae better, and the basilar portions of the occipital bones. Epiphyseal union was assessed for long bone epiphyses, clavicles, and scapulae. For older adolescents, degrees of fusion were also assessed for bones of the hands and feet.

**Figure 4.14: Unfused epiphysis comprising the immature head of the femur of a 3-5year old (Burial 138)**

**Figure 4.15: Unfused epiphysis of a juvenile distal femur compared to a fully fused adult epiphysis**

For adults, age-at-death was estimated by evaluating age-related degenerative changes occurring on the pubic symphysis and auricular surfaces of the os coxae (see Lovejoy et al. 1985), cranial sutures (Meindl and Lovejoy 1985), and sternal rib ends (Iscan and Loth 1986), and dental attrition. Osteoarthritic change (eburnation, erosion, lipping, and various manifestations of osteophytosis) was also assessed for vertebrae and for the articular surfaces of various long bones. Late fusing skeletal elements such as the sacral vertebrae, basilar synchondrosis, and the medial epiphysis of the clavicle were also useful for distinguishing young adults from older remains, although there were a few cases in which skeletons that demonstrated advanced age-related changes in other features had incompletely fused sacral vertebrae. Delayed development of this kind, when not consistent with several other reliable age indicators, was considered an anomaly and was noted, but discounted for age estimation. Evidence of delayed development has been considered however, in relation to load-bearing and other stressors that might reasonably have interfered with the development of particular bones. The potentially high skeletal stress of forced labor may also have brought about premature degeneration of bones of the spine and true joints relative to chronological age. We believe that a conservative and reasonable accounting was given to each of these considerations.

The auricular surfaces of the ox coxae were more frequently preserved than pubic symphyseal surfaces. Age-related changes in auricular surfaces were evaluated in accordance with phases delineated by Lovejoy et al., 1985). Changes in the morphology of pubic symphyseal faces were documented according to the Todd (1921), and with consideration of methodological issues raised by Brooks and Suchey (1990), Katz and Suchey (1986), and Katz and Suchey (1989). By comparison with standard casts. For both features, differences between the left and right sides were noted and recorded. Sternal rib change was evaluated according to phases defined by Iscan, Loth, and Wright (1984), and osteoarthritic variation was scored based on standards devised by Stewart (1958).

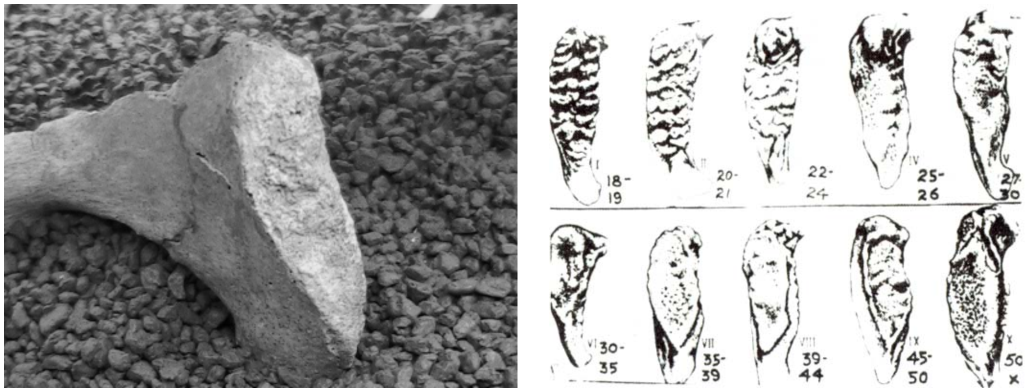


**Figure 4.16: Pubic symphysis of a 45 – 50 year old male (Burial 20, left) and Todd's ten typical phases of age in the pubic symphysis**

Various degrees of cranial suture closure were evaluated, according to the scoring system devised by Meindl and Lovejoy (1985). When possible, suture closure was scored bilaterally, since asymmetry in fusion rates was noted frequently. We were pleased to find that, while the age ranges estimated by this method tended to be very widely distributed, the mean age based on suture closure tended to be consistent with those of other aging methods. This method is clearly superior to earlier aging methods using this criterion. A maximum of 65 degenerative indicators of aging were scored for each individual.

After all available indicators had been evaluated, a composite age range and mean were determined. When ages ascertained from various features clustered tightly (usually within 6-24 months for sub-adults, within 5-10 years for well preserved adult skeletons), every indicator was included in the composite age range, defining the low and high possible ages for the individual. In some cases, however, the age range estimated from, perhaps, one criterion (usually cranial suture closure, according to the method of Meindl and Lovejoy (1985), produced unusually broad age-ranges, whose medians, however, were very consistent with those of other methods) differed widely from the others. When this occurred, more weight was given to indicators whose ages clustered than to outlier ages such as cranial suture age-range scores. Such outliers were recorded but did not become part of the composite age. A mean of the resulting composite age has been used for all analyses for ease of statistical manipulation. Wider age ranges, however, are especially useful when considering an *individual* skeleton because it will describe the likely error (the possible ages of that person at his or her death). The Burial Descriptions in Section IV of this report use such broad age ranges. When *samples or groups* of individuals are evaluated, especially the sizable archaeological population reported here, the single, average age for each individual becomes an adequate operational summary of their ages for statistical manipulation. Having many individuals within each analytical cell or field (such as the five or even one year age categories we have used) means that they will represent the range of error (randomly biased above and below the true age) by virtue of the diversity and number of individual's age estimates that, when large, begin to approach theoretical probability in which the biases cancel each other. In other words, the errors of bias are reduced in statistical treatments of groups by having sizable numbers of age-estimated individuals whose biased ages will be randomly too low for some and too high in others. Since these random, but small, errors in each direction will cancel each other out, the narrow age range in which their means fall (the one or five year interval around their mean ages in the above histogram in Figure 4.17, below) constitutes a reasonable operational summary age for the age *group* in question. One solution to the problem of smaller archaeological populations is to use very broad temporal groupings to accommodate the random errors of small populations so that one is reasonably certain an individual lies within the category of say, “adult” or “infant.” We believe that our sample is sufficiently large and the data set is extensive enough to use one-year age intervals for the demographic analysis of subadults whose developmental ages are the most accurately assessed and five-year intervals for adults under 55 years of age. The idiosyncrasies of skeletal variation in older individuals are too great for more a more reliable age estimate than 55+.

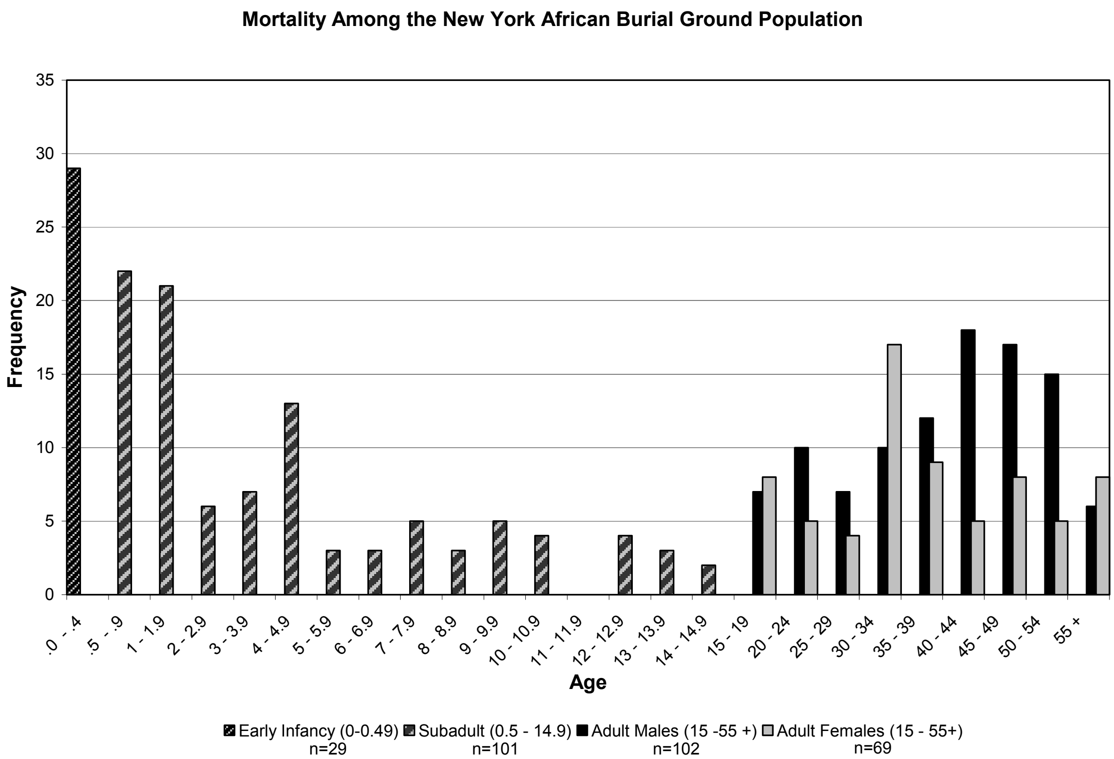


**Figure 4.17: Bar Graph representing sex and age at death using average ages**

## Dental Assessment

After the skeletal remains of each burial were cleaned and reconstructed the dentition for each burial (permanent and/or deciduous) was cleaned, identified, assessed and curated separately by the laboratory director and his assistants. Data collection was performed under the guidelines set forth in *Standards for Data Collection for Human Remains, Arizona State University Anthropology System*, and the methodological considerations of Goodman and Rose (1990), Blakey and Armelagos (1985), Rose et al. (1983), Rudney et al., 1983), Scott (1979), Smith (1984) and others. Recordation for the deciduous and/or permanent teeth included dental inventory, measurements, morphological traits, attrition rates, enamel defects, culturally induced alterations and pathological observations. A complete photographic record was constructed for each tooth, the overall dentition and the maxillary and mandibular alveoli. If all teeth were present a maximum number of 96 measurements, and 231 coded observations of morphology and developmental pathology would be made. Additional descriptive assessments of dental pathology were also numerous.

**Figure 4.18: Laboratory Director Mark Mack conducts dental recordation**

**Assessment of Bone Pathology**

An experienced Osteologist and an Osteological Technician, with assistance of an OTA, in consultation with the Scientific Director assessed each set of skeletal remains for pathologies, anomalies and non-metric genetic traits in bone. For consistency the same Osteologist carried out most of these assessments. Where staffing changes were made for pathology assessment and coding, care was taken by the Scientific Director to establish comparability among researchers. Assessment methods included the descriptive classifications of abnormality of shape, abnormality of size, abnormal bone loss, abnormal bone formation, fractures and dislocations, porotic hyperostosis, vertebral pathology, and arthritis, and epigenetic traits used in the *Standards*. More specific descriptive subcategories of the *Standards* and traditional diagnostic interpretation (such as "meningitis," not included in the *Standards*) were included in these assessments. Pathology assessments were made as narrative descriptions as per earlier approaches than the *Standards*_ (such as the Paleopathology Associations guidelines for assessment) yet with the *Standard's* coding method in mind. The project's use of "slight" versus a "moderate" to "severe" degrees of pathology, for example, is equivalent to the use of the *Standards*' categories of "barely discernable" and "clearly present," respectively. Having begun this research while *Standards* were still in development, we had the benefit of our colleague's generous provision of the early manuscripts, the researchers developed an approach that bridged (and included) the traditional diagnostic and new, more descriptive methodologies. Chapter 10 will address the pathology codes in greater detail.

Subsequently, an OT coded these descriptions with input from the Scientific Director and Associate Director for Biological Anthropology. The project's own coding method utilized a spread sheet format that encompassed virtually all useful information of the *Standards'* coding scheme in one third of the time required to use the latter code. As one of the first projects to test the *Standards,* we consider our approach to coding to be advisable, since difficulties in coding have often been noted by those attempting to use the new protocol. Additionally, a complete photographic record was developed of all pathologies by continuous consultation between the photographers and osteological staff.

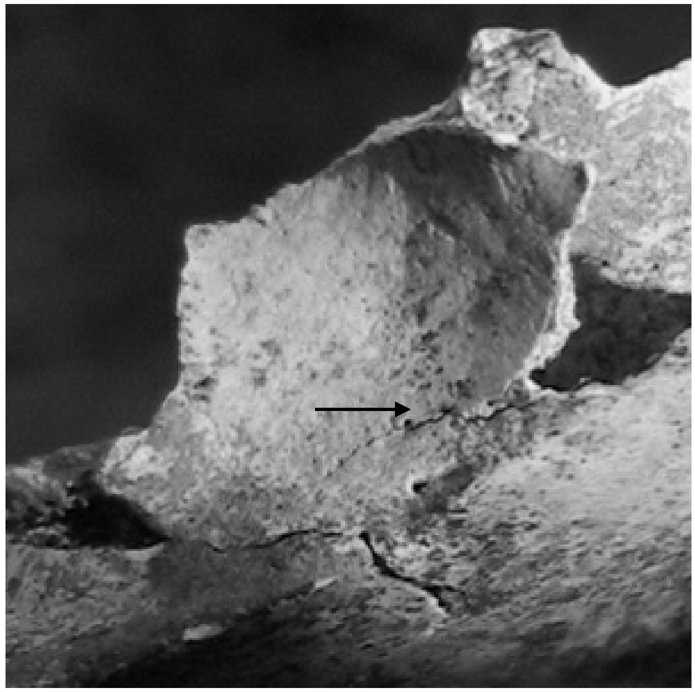

**Figure 4.19: Barely discernable porotic hyperostosis**

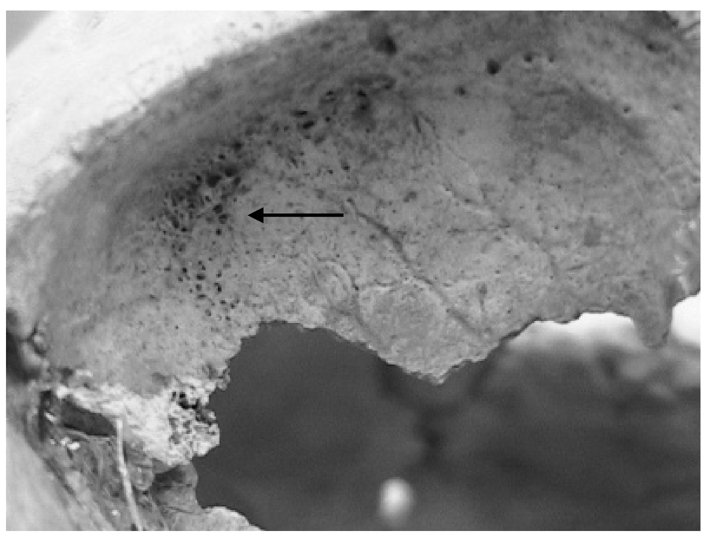

**Figure 4.20: Clearly present porotic hyperostosis**

Detailed descriptions of pathologies will be found in later chapters of this report. The project's database contains approximately 12,000 coded pathologies observed in the NYABG Population.

**Figure 4.21:Photographer Jerome Otto Edwards and Osteologist M. Cassandra Hill photographing cranium**

A photographer trained and experienced in the photographic documentation of skeletal remains was enlisted to carry out this task with the assistance of one OTA. The skeletal remains were photographed from a number of orientations to fully document each bone that contained information, as called for by the *Standards*. Photographic documentation is essential because the remains will be reburied, and photographs will provide the only visual evidence for future researchers. Osteological Technicians and OTAs contributed to photography as their experience increased over the life of the project. Photographs were later digitized at the Institute for Historical Biology, College of William and Mary and the Cobb Laboratory.

Additionally, as a means of documentation, radiographs were taken of useful crania and long bones to discover pathologies that were not readily apparent by visual observation. Inventory radiographs made by the Department of Radiology, Howard University Hospital and the Department of Orthopedics, College of Dentistry utilized x-ray settings recommended by the *Standards.* Specialized radiographs made with a portable machine of The Cobb Laboratory provided immediate images that aided assessments of age and traumatic fracture.

**Sectioned Bone Samples**

Samples of right femora, humeri, and fibulae, and a rib sample were taken according to the *Standards* protocol for sectioning. Sectioning was done after all other work was completed. Bone and dental tissue samples are to be used for histology, chemistry, DNA, histomorphometry, and curation. DNA samples (right fibulae) were cut using a clean bench with reverse airflow and handsaws were bathed in ethanol and chlorine to remove all proteins between cuts in order to eliminate inter-individual DNA contamination (mixing). Gloves and dust masks were worn at all times. All other samples were obtained with a band saw, using steel mesh gloves for personnel safety. A total of eight centimeters of bone was removed from each skeleton when possible. Appendix B contains an example of a file for a well preserved adult (Burial 101), showing the specific methods or observations mentioned in this chapter.

The New York African Burial Ground (NYABG) sample database is too large to be rendered as tables in this volume and is to be made available in electronic media.

**Skeletal Curation**

After photography and radiography, the bones from each individual were carefully stored in airtight metal cabinets under the controlled conditions described in the previous chapter of this report. The skeletal remains were routinely monitored, and we have taken curation and protection of these ancestral remains as an important, traditional, custodial duty. Public care for the remains has taken other forms including religious observances. Provision was made for a shrine at the laboratory entrance that has been kept by Ife (Yoruba) cultural practitioners.


**Figure 4.22: African-American Ife Shrine in the Cobb Laboratory**